

# Antibiotic Resistant Staphylococci

## Familial Infections Caused by Exposure of Babies in Hospital Nurseries

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HOSPITALS HAVE BECOME breeding grounds of antibiotic resistant staphylococci as a result of the intensive use of antibiotics. Most staphylococci now isolated from hospital-acquired infections are resistant to penicillin and the tetracyclines, and many are resistant to other antibiotics as well. Although this has been primarily a hospital problem, cumulative evidence indicates that resistant staphylococci are no longer confined to hospitals and are increasing in the community at large. The incidence of penicillin-resistant strains in the nasal cultures of blood donors was observed to increase from 4 per cent in 1949 to 13 per cent in 1955;<sup>9</sup> 18 per cent of blood donors in 1954 were found to carry penicillin-resistant strains in their throats.<sup>3</sup>

Some antibiotic-resistant staphylococci now present in the general population may be products of indiscreet use of antibiotics in the treatment of patients at home or in physicians' offices, but our observations and those of other investigators suggest that many have been seeded in the community by patients who have been in hospital. In one hospital 88 per cent of the staphylococci isolated from the upper respiratory tract of adult patients who were being discharged were found to be penicillin-resistant.<sup>2</sup> In many hospitals over 90 per cent of newborn infants have been found to acquire penicillin-resistant staphylococci in their noses,<sup>8</sup> and they may retain such staphylococci for long periods. While adult patients seem to lose the hospital staphylococci within a few months,<sup>2</sup> some infants have been shown to retain them for at least a year.<sup>4</sup> A recent survey<sup>5</sup> suggested that neonatally acquired resistant staphylococci may be retained for even longer periods. Forty-five per cent of children now under five years of age were found to carry penicillin-resistant staphylococci in their noses and throats, in contrast to 18 per cent of children born before the extensive use of penicillin in hospitals.

From these various observations, it is apparent that newborn infants are an important source of the

• An antibiotic resistant staphylococcus with bacteriophage pattern 52/42B/80/81\* is frequently responsible for infectious outbreaks in the newborn nursery. Some time after an outbreak had occurred in the University of California's hospital nursery, family members of the infants were found to be infected with this strain. Two families were studied in detail. In one of them, infection developed in six of the seven members within eight months after the infant's arrival. In the other, half of the family members had recurrent infections during a 13-month period.

Infants who left the nursery as asymptomatic carriers were found as likely to transmit the infectious strain as those with clinical infection. Considerable time sometimes elapsed before infection developed in either the infant or the family members. In one instance the first familial infection occurred six months after the infant had left the nursery as an asymptomatic carrier.

Newborn infants are quite likely to disseminate antibiotic resistant staphylococci which they may acquire from a hospital nursery. Infections developing among persons in contact with a young infant must be treated with the possibility of a resistant hospital staphylococcus in mind.

resistant staphylococci now found in the general population. This problem has recently become more serious because many hospital nurseries are now plagued by a highly infectious staphylococcus.<sup>10</sup> The phage pattern is variously reported as 80/81, 52/42B/80/81, or 42B/44A/47C/52/80/81\* by different laboratories. This strain commonly causes neonatal impetigo and maternal mastitis, and sometimes is the organism of fatal infections such as septicemia and pneumonia. It is invariably resistant to penicillin and the tetracyclines and, although it is usually sensitive to erythromycin and chloramphenicol, variants that are resistant to these drugs have been encountered. Several paradoxical features of infectivity also characterize this strain. Although the incidence of newborn infection with it is high, infants may carry the strain for periods of from a few days to several months before the development of clinical infection. Some infants remain healthy

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\*The code numbers are used to identify different strains of coagulase-positive staphylococci.

Chart 1.—Record of Infection in Infant and in Seven Other Members of Family

Age of Infant at Time of Infection in Self or Family	Infant	Mother	Father	Siblings				
				4 Years	5 Years	7 Years	9 Years	10 Years
5 days	<i>Carrier* Impetigo</i>							
2 weeks		<i>Breast Abscess</i>						
3 months				Boil				
4 months						<i>Furuncle Lymphangitis Carrier</i>		
5 months								Boil
6 months		Boil						
8 months	Boil		Boil		Intermittent boils			
13 months	Negative	Another strain	Another strain	Another strain	Another strain	Negative	<i>Carrier</i>	Another strain

\*Italics indicate cultures phage typed and demonstrated to be the nursery strain.

carriers indefinitely and clinical infection never develops. Either a healthy or an infected infant may transmit the strain to family members who likewise may have clinical infection after variable periods of time or may never have disease from the organism.

In January 1957 this resistant staphylococcus suddenly appeared in our hospital nursery. The outbreak of neonatal impetigo and maternal mastitis which resulted was similar in character to that experienced in many other hospitals within the past few years. Fortunately, our outbreak was of relatively short duration and subsided spontaneously in about two months without fatalities. Because of our intense interest in the problems presented by resistant staphylococci, our nursery was already under close bacteriological surveillance at the time this outbreak occurred, and we were in a position to study its genesis.<sup>6</sup>

#### STUDY OF SUBSEQUENT INFECTIONS

The infection or carrier state of each infant who left the nursery was investigated, and all staphylococci were phage typed. Subsequent infections among these infants or their families were noted, and cultures were obtained where possible for phage typing. The resulting observations demonstrated that infants born during the outbreak frequently transmitted the nursery staphylococcus to members of their families. The families of two infants who were most intensively followed serve well to illustrate this fact.

Chart 1 shows the record of infection in an infant and the parents and five siblings. The newborn infant had impetigo when it left the nursery on its fifth day, and also harbored the infectious strain

on various unaffected portions of the skin and mucous membranes. In the second week postpartum the mother developed a breast abscess which yielded the same strain as that which had affected the infant. Within the first eight months of the infant's life, all family members had staphylococcal infections except the nine-year-old sibling. Only the seven-year-old child's infection received medical attention—a furuncle with lymphangitis from which the infectious strain was recovered. When the infant had reached its thirteenth month of age, nose and throat cultures were obtained from all members of the family. At this time, only the nine-year-old child who had never had an infection was found to carry the infectious strain. Interrogation of this family elicited that a two-year-old cousin who frequently played in their home also had had frequent boils. During the fourteenth month the cousin reported to the Pediatric Clinic with impetigo of the lower extremities. Cultures of specimens from the affected skin and the nose grew the infectious staphylococcus.

Chart 2 shows the record of infection in another family, consisting of an infant, the parents and four siblings, which remained under somewhat more complete bacteriological observation. The infant left the nursery on the fourth day postpartum as an asymptomatic carrier of the infectious strain. Within the next three months the various family members had intermittent boils, but only the infant received medical attention for the lesions. Phage typing proved the organism to be due to the infectious strain. In the fourth month postpartum, the mother had two boils and impetigo in the perineal region. Cultures of material from the nose and throat obtained from the entire family at this time revealed that the mother, the infant, and two siblings were

Chart 2.—Record of Infection in Infant and in Six Other Members of Family

Age of Infant at Time of Infection in Self or Family	Infant	Mother	Father	Siblings			
				2 Years	4 Years	6 Years	8 Years
4 days	<i>Carrier*</i>						
Intermittent boils, various family members							
3 months	<i>Boil</i>						
4 months	<i>Carrier</i>	<i>Carrier</i> Boils, Impetigo	Negative	<i>Carrier</i>	<i>Carrier</i>	Another strain	Another strain
Tetracycline, all family members							
7 months	<i>Carrier</i>	<i>Carrier</i>	Negative	Another strain	<i>Carrier Furuncle</i>	<i>Carrier</i>	<i>Carrier Furuncle</i>
Erythromycin, all family members							
7.5 months	<i>Carrier</i>	<i>Carrier</i>	Negative	<i>Carrier</i>	<i>Carrier</i>	<i>Carrier</i>	Another strain
12 months					Furuncle		Furuncle
13 months	Negative	<i>Carrier Boil</i>	Negative	Negative	Another strain	<i>Carrier</i>	<i>Carrier</i>

\*Italics indicate cultures phage typed and demonstrated to be the nursery strain.

carrying the infectious strain. The attending physician, not aware that the strain was tetracycline-resistant, treated the entire family with tetracycline for several weeks, without benefit. In the seventh month two siblings had furuncles due to the infectious strain, and they as well as three other family members were again found to be carrying the organism in the nose or throat. The entire family was then treated with erythromycin, to which the strain was known to be sensitive *in vitro*. However, after a week of therapy four of the five previous carriers continued to harbor the infectious strain in their throats; it was also now obtained from the throat of the two-year-old child. (This illustrates the well known difficulty of clearing the throat of a pathogenic organism. Similar failures have been experienced when attempting to clear the throat of hemolytic streptococci.) Infections continued to occur in this family. When members of the family were last examined, at the thirteenth month, the infectious strain was recovered from the nose, the throat and a boil of the mother, as well as from the nose and throat of two siblings. At this time cultures from the nose and throat of the infant were negative, but the strain seems securely established in this family and likely to persist.

Similar observations on familial infections, although somewhat less completely documented by phage typing, have been reported by Colbeck,<sup>1</sup> Kempe,<sup>7</sup> and Wentworth, Miller, and Wentworth.<sup>11</sup> These observations leave little doubt that the newborn is quite likely to disseminate staphylococci acquired in a hospital, and they demonstrate that staphylococcal infection in persons who are in con-

tact with newborn infants are not likely to respond to antibiotics prescribed at random. Penicillin and the tetracyclines are likely to be valueless, and other antibiotics should be considered. Antibiotic sensitivity tests are an essential guide in the management of severe infections and of infections that do not readily respond to the antibiotic used first.

The staphylococcal infections now dealt with by pediatricians and general physicians must be treated with the possibility of a hospital strain in mind. Association between the infection and previous hospitalization of the patient or members of his family is not always readily apparent, as was illustrated by a case in the present study. Incidental to our research, phage typing has been performed on all staphylococci observed in the hospital's routine diagnostic laboratory. One culture received in July was puzzling for it came from a carbuncle of an outpatient, and the phage pattern was identical to that which had caused an outbreak of infection in the nursery six months previously. Upon examination of the patient's record it was noted that she had given birth to a premature infant in our hospital just at the time of the outbreak. The baby was among those who left the nursery as an asymptomatic carrier of the infectious strain. Since neither the mother nor the child had had clinical infection during the intervening months, it is doubtful whether this woman's infection would have been associated with the nursery except for the chance circumstance of our research investigation.

Antibiotic-resistant staphylococci are probably far more widely distributed in the community than is generally recognized. Their prevalence will continue

to increase so long as newborn infants bring them home from the nursery and continue to carry them. A solution to this problem will rest in part upon prevention of the acquisition of resistant strains by newborn infants during their stay in the nursery.

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### Doctor Is Not The Chief Victim

A PANEL OF DOCTORS and lawyers got nowhere in their discussion of malpractice suits the other day in San Francisco.

Launching the argument, Judge Eustace Cullinan asked: "Why should doctors think they should be immune to malpractice suits?" This question puts emphasis on the wrong aspect of the situation growing out of the trend toward bigger and more frequent damage suits filed against doctors by disgruntled patients.

The ultimate victim is not the doctor but the patient, the person who needs the benefits of new developments in medicine and surgery. Most of these are still experimental to a certain degree.

Many doctors find themselves sticking to the old and time-tested treatments. The patient may be denied a "miraculous" recovery, but the doctor will be spared a malpractice suit.

For the good of both, the malpractice suit epidemic needs to be checked, but not by denying wronged parties the right to seek redress for real incompetence, real negligence. A step in the right direction is being taken by the profession in seeking to get doctors to abandon their unwillingness to testify against one of their own number; when courts and juries can believe that expert testimony in defense of an accused doctor is honest testimony and not motivated by "we-must-hang-together ethics," damage awards will be more realistic.

—Redwood City (California) "Tribune"